1 Introduction

This is the inaugural report regarding our progress at the BFMC. Our primary objectives for this phase included achieving manual vehicle movement using the provided demo code, reviewing competition regulations, and establishing team roles. Furthermore, we focused on defining our Project Plan and System Architecture to streamline development.

Despite being in the early stages, the team spirit is high, and we have successfully established the foundational structure for autonomous development.

2 Planned activities

At the beginning of this period, the following activities were planned:

- Team Organization: Assigning roles and creating the GitHub repository.
- Defining our Project Plan and Architecture: We defined the activities to follow so we can have successful participation in the challenge; these activities can change over time.
- Environment Preparation and Hardware Verification: Installing the startup code provided by Bosch and Testing the physical car components and ensuring remote connectivity.
- Basic Control: Achieving manual movement of the car using the demo code.

3 Status of planned activities

- Team Organization: Completed. We successfully configured the development tools and synchronized our repository, and the roles of each member are defined. Diego (V2X), Angel (Computer Vision & Brain), Leonardo (High-Level Logic), Francisco (Embedded Systems), and Adriana (Control).
- Project Plan and Architecture: Completed. A dynamic roadmap has been established.
- Environment Preparation and Hardware Verification: Completed. We established a stable connection between the control station and the vehicle. Difficulties:
    - We encountered a mismatch between the XT60 battery connector and the XT90 board connector, temporarily resolved via screw terminals.
    - Initial Raspberry Pi imaging issues occurred due to custom user and password configurations; this was resolved by reverting to the default (pi/raspberry) credentials.
- Basic Control: Completed. The car can be moved forward, backward, and steered manually. Difficulties:
    - Our current 7.4V 2200mAh 2C LiPo battery discharges rapidly; we'll get a higher-capacity battery with XT90 connector for future phases.

4 General status of the project

Currently, the project is in the Initial Prototype Phase. The car can successfully execute manual commands for traction and steering, meeting the requirements for this first milestone. However, the vehicle still lacks autonomous perception. The lane detection module needs significant development to transition from manual to autonomous mode.

5 Upcoming activities

For the next period, we will focus on transitioning from manual control to basic autonomous navigation:

- Perception & Vision Pipeline: Implementing a Lane Detection algorithm using the onboard camera. This includes image preprocessing (cropping, blurring, and color filtering) and Canny edge detection or Hough Transforms.
- Control Integration: Developing the interface to link vision data to steering outputs, specifically focusing on Lane Following logic.
- Simulation & Testing: Utilizing the BFMC simulator to validate algorithms in a risk-free environment before deploying code to the physical car.
- Calibration & PID Tuning: Starting the initial calibration of the steering servo and motor controllers to ensure smooth movement during autonomous transitions.
- V2X Research: Beginning the study of the communication protocols required for upcoming intersection and traffic sign challenges.